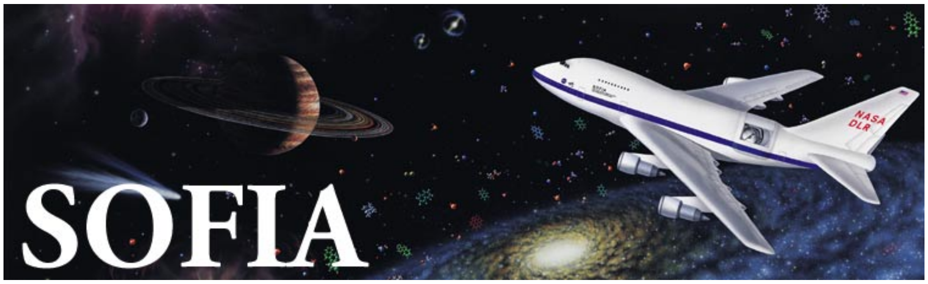
HAWC

SOFIA's Facility Far-Infrared Camera



When SOFIA enters operation, it will be the largest far-infrared telescope available, so it will have the best intrinsic angular resolution. HAWC is a first-generation facility instrument for SOFIA. It is a far-infrared camera designed to cover the 40-300 micron spectral region at the highest possible angular resolution. HAWC's goal is to provide a sensitive, versatile, and reliable far-infrared imaging capability for the astronomical community during SOFIA's first years of operation.

HAWC Science

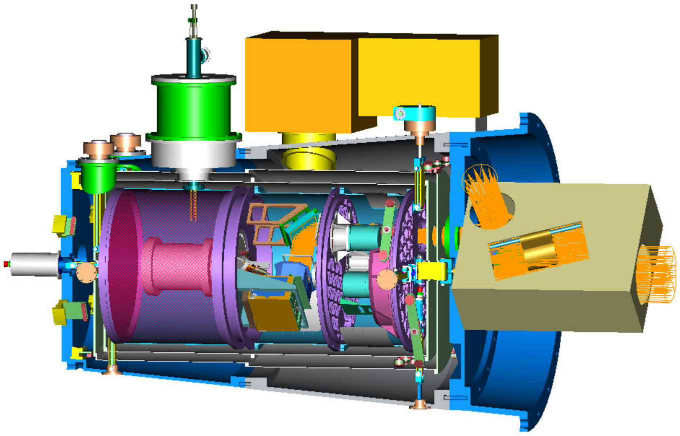
Many infrared sources are dusty. Absorption of starlight typically heats the dust grains to temperatures of tens or hundreds of degrees Kelvin. They radiate most of their energy in the far-infrared at wavelengths of 40-300 microns which are inaccessible from the ground. Imagery in this spectral range with the highest possible angular resolution is the natural starting point from which to develop an understanding of source energetics and morphology. It also plays a central role in studies of the physics and chemistry of the interstellar clouds which feed and catalyze the evolution of stars and galaxies.

SOFIA's angular resolution will make it possible to study the evolution of stars, planetary systems, and galaxies in unprecedented detail. SOFIA will provide the first far-infrared images which can be directly compared with the wealth of arcsecond-scale data now available at other wavelengths. Its light gathering power will allow studies of many sources in a wide range of environments, from low-mass stars in nearby dark clouds to young star clusters in low-metallicity dwarf galaxies to luminous starbursts in merging galaxies and active galactic nuclei. Some of the scientific problems which will be addressed include the following:

- The formation of stars and stellar clusters within our galaxy.
- Star formation in external galaxies.
- The nature and evolution of protoplanetary and remnant disks around nearby stars.
- The structure and energetics of interstellar clouds.
- The return of gas and dust to the interstellar medium from evolved stars.
- Conditions in regions surrounding active galactic nuclei.
- High-z galaxies.

The drawing to the right shows a cutaway view of HAWC's critical optical and cryogenic systems. The bolometer detector array is cooled to a temperature of 200 mK by an adiabatic demagnetization refrigerator which operates from a base temperature of 4 K provided by a liquid helium reservoir and two vapor-cooled radiation shields.

The optics consists of four interchangeable sets of re-imaging lenses which enable optimized, diffraction-limited imaging at wavelengths of 53, 89, 155 and 215µm.



Specifications

Wavelength Range:	40 to 300 microns
Wavebands:	53 microns (Band 1) 89 microns (Band 2) 155 microns (Band 3) 215 microns (Band 4)
Bandwidths	Band 1 – 10% Band 2 – 10% Band 3 – 15% Band 4 – 20%
Pixel Size	Band 1 – 2.25 arcsec Band 2 – 3.50 arcsec Band 3 – 6.00 arcsec Band 4 – 8.00 arcsec
Detector Field of View	Band 1 – 27x72 arcsec Band 2 – 42x112 arcsec Band 3 – 72x192 arcsec Band 4 – 96x256 arcsec
Detectors:	12x32 array of “pop-up” bolometers
Detector Quantum Efficiency:	50% in all bands
Background power per pixel	Band 1 – 0.014 nW Band 2 – 0.023 nW Band 3 – 0.027 nW Band 4 – 0.021 nW
NEP (thermal background limit, 1 pixel in 1 sec.)	Band 1 – 0.09 fW Band 2 – 0.11 fW Band 3 – 0.08 fW Band 4 – 0.06 fW
NEFD: (1σ, chopped, background limit, extended source, $A\Omega=\lambda^2$)	Band 1 – 0.75 Jy (1 sec) Band 2 – 0.72 Jy (1 sec) Band 3 – 0.69 Jy (1 sec) Band 4 – 0.43 Jy (1 sec)
NEFD ((1σ, chopped, background limit, extended source, $A\Omega=\lambda^2$)	Band 1 – 12.5 mJy (1 hour) Band 2 – 12.0 mJy (1 hour) Band 3 – 11.5 mJy (1 hour) Band 4 – 7.2 mJy (1 hour)

The HAWC Team

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For more information, visit http://www.sofia.usra.edu/observatory/instruments/

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